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Thus at most seven μ 's can be determined by the seven λ 's. If however G has one involutorial set, it has ∞^1 such sets.⁴ If therefore F admits one Δ_7 , it must admit $\infty^1 \Delta_7$'s.

¹ A variable system of sevens on two twisted cubic curves, these PROCEEDINGS, 2, 337 (1916).

² In the sense that other analogous porisms can be based on the properties of an algebraic (2, 2) form.

³ The number of poristic forms of the special type which factor into three bilinear forms was estimated at ∞^3 instead of ∞^5 .

⁴ Coble, Symmetric binary forms and involutions, *Amer. J. Math.*, 31, 189.

A CONTRIBUTION TO THE PETROGRAPHY OF THE PHILIPPINE ISLANDS

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A very large part of the volcanic rocks of the Philippine Islands occur as tuff-breccias with flows and dikes of massive lava, and a very great area of country is covered with vegetation, so that it will be many years before anything like a thorough knowledge of the igneous rocks of the region will be acquired. Fragmentary contributions to the petrography of the islands are the most that may be expected for some time. Already it is known that the principal volcanic rocks are andesites with much fewer basalts and dacites, and almost no rhyolites. A short visit to Luzon in 1910 enabled one of us to study the collections in the Mining Department of the Bureau of Science [Iddings, J. P., *Philippine J. Sci.*, 5, 155, 1910,] and to collect specimens from some of the more accessible localities on the island. From these specimens the accompanying chemical analyses have been made by Dr. Morley.

The first three analyses are from basaltic lavas having andesitic characters. The rocks are porphyritic with andesitic habit to the groundmass and a variable amount of modal olivine, which is present in the rocks from Antipolo and Taal, but does not appear in the specimen from Mayon which was analyzed, though it occurs in other lava from the same volcano. The normative plagioclase in each case is labradorite.

The basalt from Antipolo, anal. 1, is massive lava from near the waterfall. It is magnophyric and seriate porphyritic with phenocrysts of labradorite and smaller ones of olivine. The groundmass consists of prismoid and anhedral feldspar, anhedral pyroxene and euhedral

magnetite. The norm contains a small amount of quartz, no olivine, and plagioclase which is approximately $Ab_2 An_3$.

The basalt from the south base of Taal volcano, anal. 2, is massive lava on the shore of the lake which surrounds the volcano, and is overlaid by tuffs from more recent eruptions. It has small phenocrysts of plagioclase, augite and olivine, and has more mafic minerals than the rock from Antipolo, but the feldspar is less calcic. The rock is transitional to andose.

The lava from Mayon volcano, anal. 3, is labradorite-andesite, with augite and hypersthene and without noticeable olivine. The norm contains 5% of quartz, but the rock is hessose, closely similar to the basalts from Taal and Antipolo. Other lavas from Mayon contain olivine.

The rock from Benguet Road, anal. 4, is holocrystalline hornblende-andesite or andesite-porphyry, slightly altered. The phenocrysts of plagioclase are zonal with alternating shells which differ in composition, more or less calcic. The hornblende is brownish green, in part altered to chlorite, epidote and calcite. The rock is intruded in andesitic breccias and lavas. The hornblende-andesite from Olongapo, anal. 5, is seriate magnophyric with phenocrysts of zonal plagioclase with alternating zones differing in composition as in the rock from Benguet Road, the outermost zone being strongly calcic instead of strongly sodic as is commonly the case. The hornblende is brown with black border, and opaque paramorphs of hornblende are abundant.

The dacite from Corregidor Island in Manila Bay, anal. 6, is a dense white porphyry forming a large massive body on the sea coast near the landing. It is dopatic and seriate mediophyric, with phenocrysts of glassy plagioclase, quartz and biotite. The groundmass is holocrystalline and seriate microporphyritic, consisting of minute phenocrysts of prismoid plagioclase and abundant microscopic euhedral bipyramidal quartzes in a microcrystalline matrix which besides quartz and alkalic feldspar must contain some kaolin, judging from the chemical analysis and norm, for there is 5% of normative corundum, a large amount of normative quartz and 2.5% of water. The calculated kaolin is 13% which is probably more than is actually present, as some of the normative corundum and water belongs to the modal biotite. The rock is albachose, and is the most siliceous volcanic rock from the Philippines so far analyzed. It is interesting to note that the volcanic rocks in these islands are like many in Japan and in western America.

CHEMICAL ANALYSES OF ROCKS FROM LUZON, P. I.

	1	2	3	4	5	6
SiO ₂	50.54	52.33	53.06	58.54	60.13	72.68
Al ₂ O ₃	21.63	17.18	19.68	16.79	17.51	15.77
Fe ₂ O ₃	3.64	3.51	3.24	1.89	3.25	0.65
FeO.....	4.22	5.73	4.94	3.33	0.91	0.21
MgO.....	3.06	5.30	3.64	3.27	3.35	0.41
CaO.....	10.47	10.71	9.41	7.25	6.54	1.66
Na ₂ O.....	2.88	3.17	3.24	3.76	3.78	3.26
K ₂ O.....	1.57	0.94	0.94	1.62	0.77	2.19
H ₂ O—.....	0.19	0.00	0.01	0.04	1.45	1.18
H ₂ O+.....	0.72	0.38	0.06	1.24	0.90	1.38
TiO ₂	0.34	0.31	0.77	0.70	0.44	0.09
P ₂ O ₅	0.24	0.22	0.33	0.66	0.68	0.22
CO ₂	0.04	0.02	0.00	0.69	0.02	0.00
ZrO ₂	0.00	0.00	0.00	0.01	0.00	0.00
Cl.....	0.08	0.08	0.08	0.04	0.09	0.02
F.....	0.02	0.05	0.07	0.05	0.02	0.01
S.....	0.01	0.03	0.03	0.04	0.02	0.05
Cr ₂ O ₃	0.01	0.01	0.00	0.01	0.00	0.00
MnO.....	0.17	0.24	0.59	0.13	0.27	0.16
BaO.....	0.05	0.07	0.06	0.04	0.03	0.02
SrO.....	0.04	0.03	0.02	0.01	0.01	0.03
	99.92	100.31	100.17	100.31	100.17	99.99

Norms

	0.90	0.96	4.98	11.94	18.00	41.46
q.....	0.90	0.96	4.98	11.94	18.00	41.46
or.....	9.45	5.56	5.56	9.45	5.00	12.79
ab.....	24.63	27.25	27.25	31.96	31.96	27.77
an.....	41.14	29.75	36.42	24.19	27.52	7.51
c.....					0.31	5.30
di.....	8.34	18.27	6.80	5.81		
hy.....	8.00	11.82	11.85	8.97	8.40	1.00
mt.....	5.34	5.10	4.64	2.78	2.78	0.93
il.....	0.61	0.61	1.52	1.37	0.76	0.15
hm.....					1.44	
ap.....	0.34	0.34	0.67	1.68	1.68	0.34
etc.....	1.16	0.67	0.33	2.17	2.54	2.69
	99.91	100.33	100.02	100.32	100.39	99.94

1. Basalt, hessose, II.5.4.4. Antipolo.
2. Basalt, andose-hessose, II (III).5.(3)4.4'. Taal volcano.
3. Labradorite-andesite, hessose, II,'5.'4.4'. Mayon volcano.
4. Hornblende-andesite, tonalose, II.4'.3.4. Benguet road.
5. Hornblende-andesite, placeros-tonalose, (I) II.4.3'.4(5), Olongapo.
6. Dacite, alsbachose, I.3.2.4. Corregidor Island.